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Indian Standard
SPECIFICATION FOR
RESPIRATORS, CANISTER TYPE (GAS MASKS)

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*Indian Standard*SPECIFICATION FOR
RESPIRATORS, CANISTER TYPE (GAS MASKS)

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Indian Standard

SPECIFICATION FOR RESPIRATORS, CANISTER TYPE (GAS MASKS)

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 14 March 1977, after the draft finalized by the Industrial Safety Advisory Committee had been approved by the Executive Committee.

0.2 Control of a chemical process or operation by adopting technical measures, such as enclosure of equipment, adequate ventilation and remote handling, is essential for preventing pollution of work environment due to air borne toxic contaminants in the forms of gases, vapours, dusts, mists, fumes and smokes, and for protection of health. Where the work environment still becomes polluted or when there is a possibility of employees being exposed to high levels of toxic air contaminants, use of appropriate respiratory protective equipment becomes essential. It is desirable that such equipment is tested under simulated conditions in the laboratory and any defects removed so that necessary protection is afforded in actual use.

0.3 In the preparation of this standard assistance has been drawn from the following publications:

JIS T 8152-1972 Gas masks. Japanese Industrial Standards Committee.

NZ SS 2266-1969 Personal respiratory protective devices for the removal of atmospheric contaminants. Standards Association of New Zealand.

IC 7600 Approval system for respiratory protective devices. The Bureau of Mines, USA.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard prescribes the requirements and methods of sampling and test for respirators, canister type, commonly called gas masks, with face piece or mouth piece, for use for protection in atmospheres containing toxic gases and vapours, with or without particulate contaminants.

1.1.1 This standard does not cover self-rescuers normally used in coal mines.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 8437-1977* and the following shall apply.

2.1.1 *Front-Mounted or Back-Mounted Gas Mask* — An equipment consisting of full face piece, breathing tube, canister, canister harness and associated connections, designed for entry into or escape from atmospheres containing harmful contaminants. The canister may be worn at the front or back.

2.1.2 *Chin-Type Gas Mask* — An equipment consisting of a full face piece, canister and associated connections, designed for entry into or escape from atmospheres containing harmful contaminants. The canister is usually attached directly to the face piece.

2.1.3 *Escape Gas Mask* — An equipment consisting of a half mask face piece or mouth piece, canister and associated connections designed for *escape only* from atmospheres containing harmful contaminants.

3. CLASSIFICATION

3.1 Respirators, canister type, are classified according to: (a) their construction, (b) the specific gas(es) or vapour(s) they are designed to protect against, and (c) the concentration(s) of gas(es) or vapour(s) they are designed to protect against.

3.2 The maximum gas/vapour concentration, percent by volume, against which these devices may afford protection is given in Table 1. For approval under this specification, the respirators shall be tested against the specified concentrations according to procedures given in this standard.

3.3 Respirators for protection against other gases and vapours (except pesticides) and against particulate materials in combination with gases and/or vapours may also be approved according to this standard.

3.4 Respirators which are a combination of canister type and another type(s) of respirator(s) covered by another standard may also be approved according to this standard.

3.5 The manufacturer shall state how production items will be tested to maintain quality control of the respirators and its component parts.

*Glossary of terms relating to respiratory protective devices. (*under preparation*),

TABLE 1 MAXIMUM VOLUME CONCENTRATIONS OF CONTAMINANTS FOR WHICH THE CANISTER SHOULD PROVIDE PROTECTION

(Clause 3.2)

Sl. No.	CONTAMINANT	CONCENTRATION, PERCENT, FOR		
		Front or Back-Mounted Gas Mask	Chin-Type Gas Mask	Escape Gas Mask
(1)	(2)	(3)	(4)	(5)
i)	Acid gases	2.0 (Notes 1 and 2)	0.5 (Notes 1 and 2)	0.1 (Notes 1 to 4)
ii)	Ammonia	3.0 (Note 1)	0.5	0.5 (Note 3)
iii)	Carbon monoxide	2.0 (Note 1)	Not recommended	1.0
iv)	Organic vapours	2.0 (Notes 1 and 2)	0.5 (Notes 1 and 2)	0.5 (Notes 1 to 3)

NOTE 1—Approval may be for acid gases or organic vapours as a class or for specific acid gases or organic vapours. Approval may also be granted for combinations of any or all of these materials.

NOTE 2—Not for use against acid gases or organic vapours with poor warning properties or which generate high heats of reaction with sorbent material in canister.

NOTE 3—Eye protection may be required in certain concentrations of acid gases, ammonia and organic vapours.

NOTE 4—Suggested maximum use concentrations are lower than these for some acid gases and organic vapours.

4. DESIGN AND CONSTRUCTION

4.1 General Requirements—The respirator shall be constructed of suitable material, with good workmanship, and designed on sound engineering and scientific principles. The following factors of design and construction shall be considered: safety; distribution of weight; durability of construction; practicability of wearer use including comfort; field of vision; fit of mouth piece, nose-clip, and face piece; and performance during investigation and testing, including any adverse effects on the wearer of the gas mask.

4.2 Functional Parts—All component parts shall be designed, constructed, and fitted in such a manner that they will not create a hazard to the wearer. Replacement parts shall be easily installed and shall maintain the effectiveness of the respirator. The respirator shall be so constructed as to readily permit inspection and repair of functional parts. All parts requiring cleaning and disinfecting shall be readily accessible. All parts in contact with the wearer's body shall be of non-irritating composition.

4.3 Durability in Normal Handling and Disinfection — All materials used in construction, fabrication, or assembly of canisters shall not be damaged in normal handling. All materials used in construction of a face piece or mouth piece and nose clip shall withstand repeated disinfection by methods that are recommended by the manufacturer and are acceptable. These methods shall be specified by the manufacturer.

4.4 Full Face Piece — A respirator shall be provided with a face piece or mouth piece and nose clip. Front-mounted, back-mounted or chin-type respirators shall be provided with a full face piece meeting the requirements given below.

4.4.1 The full face piece shall fit persons of varying facial contours and sizes or more than one face piece sizes may be provided to fit varying facial contours and sizes.

4.4.2 The wearer's field of vision shall be adequate and not distorted by the eye piece(s). Eye pieces shall meet the pertinent requirements for impact and penetration specified in the relevant standards. Face piece design shall minimize fogging. The face piece shall have, or be capable for having added to it, a provision for use of corrective spectacles. The use of spectacles shall not reduce the respiratory protective qualities of the respirator.

4.4.3 An inhalation valve(s) or other means shall be provided to prevent exhaled air from adversely affecting the canister. The valve shall be protected against distortion.

4.4.4 An adjustable and replaceable head harness, capable of maintaining tension under all circumstances shall be provided.

4.4.5 An exhalation valve is required and shall be provided with a cover for its protection. The cover shall provide a dead air space to prevent inward leakage of contaminated air.

4.5 Half Mask Mouth Piece and Nose Clip — The mouth piece and nose clip shall meet the requirements given in **4.5.1** to **4.5.4**.

4.5.1 The half mask face piece shall fit persons of varying facial contours and sizes or more than one face piece size may be provided to fit varying facial contours and sizes. The wearer's field of vision shall be adequate.

4.5.2 An exhalation valve(s) is required and it shall be provided with a cover for its protection. An inhalation valve(s) or other means shall be provided to prevent excessive exhaled air from adversely affecting the canister. Valves shall be protected against distortion.

4.5.3 An adjustable and replaceable head harness having suspension from four or more points, giving even distribution of tension at the top and bottom, shall be provided for a half mask face piece. If a mouth piece

and nose clip are used, both shall be provided and shall be attached to each other to prevent accidental loss.

4.5.4 A mouth piece for use with a replaceable canister shall be fitted with an adjustable and replaceable head harness having suspension from two or more points, giving even distribution of tension at the top and bottom.

4.6 Containers — Durable containers shall be provided for storage of each respirator. Each container shall be identified with the appropriate markings. The respirator shall be easily removable from the container. Containers shall be sealed to protect them against moisture or dryness during storage.

4.7 Breathing Tube — When a flexible breathing tube is part of the respirator construction, it shall not restrict free head movement, disturb face piece fit or otherwise interfere with the wearer's activity. It shall not shut off air flow because of kinking or chin or arm pressure.

4.8 Harness — A front-mounted, back-mounted and when necessary, an escape gas mask, shall be equipped with a harness constructed so that it will hold the canister securely in position against the wearer's body. The harness shall permit convenient replacement of the canister and shall provide for holding the face piece or mouth piece in the ready position when the face piece or mouth piece is not in use.

5. TESTS

5.1 Breathing Resistance Test — Resistance of the entire respirator to air flow shall be measured at the face piece before and after the pertinent tests are performed. The gas mask face piece shall be mounted on a test fixture with air flowing at a continuous rate of 85 litres per minute. The requirements for resistance are as follows :

<i>Type of Gas Mask</i>	<i>Inhalation Resistance, Max</i>		<i>Exhalation Resistance, Max</i>
	<i>Initial mm H₂O</i>	<i>Final mm H₂O</i>	
Front-mounted or back-mounted (without particulate filter)	55	70	20
Front-mounted or back-mounted (with approved particulate filter)	65	80	20
Chin-type or escape (without particulate filter)	35	50	20
Chin-type or escape (with approved particulate filter)	50	70	20

5.2 Exhalation Valve Leakage — The dry exhalation valve and valve seat will be subjected to a suction of 25 mm H₂O while in the normal operating position. Leakage between the valve and valve seat shall not exceed 30 ml per minute.

5.3 Face Piece Tests — The complete respirator shall be fitted to the face of three persons having varying facial shapes and sizes. The face piece or mouth piece fit test shall be carried out using positive or negative pressure as recommended by the manufacturer and described in the instructions. Any respirator part which has to be removed to perform the face piece or mouth piece fit test shall be replaceable without special tools and without disturbing the face piece or mouth piece fit. The face piece or mouth piece fit test shall be performed by each person prior to other tests described. If the manufacturer specifies a face piece size for his respirator(s), and furnishes approximate measurements of faces they are designed to fit, test subjects will be selected to suit those facial measurements to the extent possible.

5.3.1 Face Piece Fit Test — Each person wearing a gas mask shall enter a chamber containing 1 000 ppm concentration of *iso*amyl acetate vapour. Each person shall remain in the chamber for 8 minutes and perform certain activities as follows :

- a) 2 minutes — nodding and turning head
- b) 2 minutes — calisthenic arm movements
- c) 2 minutes — running in place
- d) 2 minutes — pumping air with air pump into 0.1 m³ cylinder.

5.3.1.1 No subject shall detect the odour of *iso*amyl acetate during the test. The face piece or mouth piece may be adjusted, if necessary, in the test chamber before starting the tests.

5.4 Dust, Fume, Mist and Smoke Tests — Respirators containing filters for protection against dusts, fumes, mists and smokes in combination with gases, vapours, or gases and vapours, shall be tested to determine the adequacy of the protection afforded.

5.4.1 Canisters designed for protection against dusts, fumes and mists shall be tested for this purpose according to the procedures given in 'Indian Standard specification for dusts, fumes and mists filter respirators' (under preparation).

5.4.2 Canisters designed for protection against smoke shall be tested in an atmospheric concentration of 100 µg of dioctylphthalate (DOP) per litre of air at continuous flow rate of 32 and 85 litres per minute for a period of 5 to 10 seconds. The DOP leakage through the canisters shall not exceed 0.03 percent of the test concentration.

5.5 Bench Tests — The canisters shall meet the requirements of the bench tests given below. These tests are made on an apparatus that allows the test atmosphere at 65 ± 5 percent relative humidity and room temperature $27 \pm 2^\circ\text{C}$ (except for different humidity and temperature conditions for carbon monoxide tests), to enter the canister continuously at predetermined concentrations and rates of flow, and that has means for determining the test life of the canister.

5.5.1 Gas and Vapour Test — The required test concentration of the respective gas or vapour shall be prepared by mixture with air having approximately 65 ± 5 percent relative humidity and this shall be used for testing of canisters as follows:

- a) Three canisters shall be tested as received from the manufacturer;
- b) Two canisters shall be equilibrated at room temperature by passing air of 25 percent relative humidity through them at 64 litres per minute for 6 hours;
- c) Two canisters shall be equilibrated at room temperature by passing air of 85 percent relative humidity through them at 64 litres per minute for 6 hours.

5.5.1.1 The equilibrated canisters shall be resealed, kept in an upright position at room temperature, and tested within 18 ± 2 hours.

5.5.1.2 Front-mounted and back-mounted canisters shall be tested and shall meet the requirements specified in Table 2.

5.5.1.3 Chin-type respirator canisters shall be tested and shall meet the requirements specified in Table 3.

5.5.1.4 Escape respirator canisters shall be tested and shall meet the requirements specified in Table 4.

6. MARKING

6.1 Face Piece — The face piece shall be marked with the following:

- a) The name and/or trade-mark of the manufacturer,
- b) The size (if more than one size is available).

6.2 Container — The month and year of manufacture shall be marked on the supplying container.

6.3 Canister — The canister shall be marked with the following :

- a) Name and/or trade-mark of the manufacturer;
- b) The colour prescribed in 8318-1977* either on the canister or label on it;
- c) Appropriate marking in bold letters as follows :

1) **'Canister for** _____
(Name of atmospheric contaminant)

2) **'For respiratory protection in atmospheres containing not more than** _____ **by volume of**
(Concentration)
_____ (Name of atmospheric contaminant)

3) **'Do not use in atmospheres containing less than 16 percent oxygen by volume**

The above information shall be permanently attached or imprinted on the respirator.

- d) The month and year in which the canister was filled;
- e) Minimum working life and shelf life;
- f) Instructions for use; and
- g) The ISI Certification Mark.

7. PROCESS INSPECTION

7.1 Procedures for quality control during production [see IS : 397 (Part I)-1972†] shall be followed.

*Colour identification markings for air purifying canisters and cartridges.

†Method for statistical quality control during production: Part I Control charts for variables (*first revision*).

TABLE 2 CANISTER BENCH TESTS AND REQUIREMENTS FOR FRONT- AND BACK-MOUNTED RESPIRATOR CANISTERS

(Clause 5.5.1.2)

Sl. No.	TYPE OF RESPIRATOR	TEST CONDITION	TEST ATMOSPHERE			NUMBER OF TESTS	MAXIMUM ALLOWABLE PENETRATION	MINIMUM LIFE (see NOTE 1)
			Gas or Vapour	Concentration	Flow Rate			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				ppm	l/min		ppm	minutes
i)	Acid gas	As received	SO ₂	20 000	64	3	5	12
			Cl ₂	20 000	64	3	5	12
			NO _x	20 000	64	3	5	12
		Equilibrated	SO ₂	20 000	32	4	5	12
			Cl ₂	20 000	32	4	5	12
			NO _x	20 000	32	4	5	12
ii)	Organic vapours	As received	CCl ₄	20 000	64	3	5	12
		Equilibrated	CCl ₄	20 000	32	4	5	12
iii)	Ammonia	As received	NH ₃	30 000	64	3	50	12
		Equilibrated	NH ₃	30 000	32	4	50	12
iv)	Carbon monoxide	As received	CO	20 000	64 (Note 2)	2	3	60 (Note 3)
			CO	5 000	32 (Note 4)	3	3	60 (Note 3)
			CO	3 000	32 (Note 2)	3	3	60 (Note 3)
v)	Type N	As received	SO ₂	20 000	64	3	5	6
			Cl ₂	20 000	64	3	5	6
			NO _x	20 000	64	3	5	6
			CCl ₄	20 000	64	3	5	6
			NH ₃	30 200	64	3	5	6
		As received	CO	20 000	64 (Note 2)	2	3	60 (Note 3)
			CO	5 000	32 (Note 4)	3	3	60 (Note 3)
			CO	3 000	32 (Note 2)	3	3	60 (Note 3)
		Equilibrated	SO ₂	20 000	32	4	5	6
			Cl ₂	20 000	32	4	5	6
			NO _x	20 000	32	4	5	6
			CCl ₄	20 000	32	4	5	6
			NH ₃	30 000	32	4	5	6

NOTE 1 — Minimum life shall be determined at the indicated penetration.

NOTE 2 — Relative humidity of test atmosphere shall be 95 ± 3 percent, temperature of test atmosphere shall be $25 \pm 2.5^\circ\text{C}$.

NOTE 3 — Maximum allowable CO penetration shall be 385 cc during the maximum life. The penetration shall not exceed 500 ppm during this time.

NOTE 4 — Relative humidity of test atmosphere shall be 95 ± 3 percent, temperature of test atmosphere shall be $0 \pm 2.5^\circ\text{C}$.

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TABLE 3 CANISTER BENCH TESTS AND REQUIREMENTS FOR CHIN-TYPE RESPIRATOR CANISTERS

(Clause 5.5.1.3)

SL No.	TYPE OF RESPIRATOR	TEST CONDITION	TEST ATMOSPHERE			NUMBER OF TESTS	MAXIMUM ALLOWABLE PENETRATION	MINIMUM LIFE (see NOTE 1)
			Gas or Vapour	Concentration	Flow Rate			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				ppm	l/min		ppm	minutes
i)	Acid gas	As received	SO ₂	5 000	64	3	5	12
			Cl ₂	5 000	64	3	5	12
			NO _x	5 000	64	3	5	12
		Equilibrated	SO ₂	5 000	32	4	5	12
			Cl ₂	5 000	32	4	5	12
			NO _x	5 000	32	4	5	12
ii)	Organic vapours	As received	CCl ₄	5 000	64	3	5	12
		Equilibrated	CCl ₄	5 000	32	4	5	12
iii)	Ammonia	As received	NH ₃	5 000	64	3	50	12
		Equilibrated	NH ₃	5 000	32	4	50	12

NOTE 1 — Minimum life shall be determined at the indicated penetration.

TABLE 4 CANISTER BENCH TESTS AND REQUIREMENTS FOR ESCAPE RESPIRATORS

(Clause 5.5.1.4)

Sl No.	TYPE OF RESPIRATOR	TEST CONDITION	TEST ATMOSPHERE			NUMBER OF TESTS	MAXIMUM ALLOWABLE PENETRATION	MINIMUM LIFE (see NOTE 1)
			Gas or Vapour	Concentration	Flow Rate			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				ppm	l/min		ppm	minutes
14	i) Acid gas	As received	SO ₂	5 000	64	3	5	12
			Cl ₂	5 000	64	3	5	12
			NO _x	5 000	64	3	5	12
		Equilibrated	SO ₂	5 000	32	4	5	12
			Cl ₂	5 000	32	4	5	12
			NO _x	5 000	32	4	5	12
	ii) Organic vapours	As received	CCl ₄	5 000	64	3	5	12
		Equilibrated	CCl ₄	5 000	32	4	5	12
	iii) Ammonia	As received	NH ₃	5 000	64	3	50	12
		Equilibrated	NH ₃	5 000	32	4	50	12
	iv) Carbon monoxide	As received	CO	11 000	64 (Note 2)	2	3	60 (Note 3)
			CO	5 000	32 (Note 4)	3	3	60 (Note 3)
			CO	3 000	32 (Note 2)	3	3	60 (Note 3)

NOTE 1 — Minimum life shall be determined at the indicated penetration.

NOTE 2 — Relative humidity of test atmosphere shall be 95 ± 3 percent, temperature of test atmosphere shall be $25 \pm 2.5^\circ\text{C}$.

NOTE 3 — Maximum allowable CO penetration shall be 385 ml during the minimum life. The penetration shall not exceed 500 ppm during this time.

NOTE 4 — Relative humidity of test atmosphere shall be 95 ± 3 percent, temperature of test shall be $0 \pm 2.5^\circ\text{C}$.

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SHRI S. C. KALE	Directorate General, Factory Advice Service and Labour Institutes (Ministry of Labour), Bombay
SHRI M. K. MALHOTRA (<i>Alternate</i>)	
SHRI S. K. MUKHERJEE	Mines Safety Appliances Ltd, Calcutta
SHRI M. MISHRA (<i>Alternate</i>)	
SHRI C. PEREIRA	Joseph Leslie & Co, Bombay
SHRI N. RAY	The Fertilizer Corporation of India Ltd, Sindri
SHRI R. SEGAL	Industrial Medical Engineers, New Delhi
SHRI S. P. BHARGAVA (<i>Alternate</i>)	
SHRI S. D. SHROFF	Pradeep Packagers, Bombay
SHRI LAL G. SAJNANI (<i>Alternate</i>)	
SHRI A. C. SRIVASTAVA	Directorate General of Mines Safety, Dhanbad
SHRI R. L. ARORA (<i>Alternate</i>)	
SHRI HEATHCLIFF VAZ	Francis Leslie & Co, Bombay
SHRI FRANCIS LESLIE VAZ (<i>Alternate</i>)	